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THE INDIAN COTTONS.

BY

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CHAPTER I.

GENERAL REMARKS.

The cultivated cottons of India possess the following characters in common. Erect, large or small shrubs, with long tap roots and few lateral roots. *Stems* woody and brittle below, herbaceous toward extremities, usually wandlike; growth cymose from the first so that the whole plant forms a *Sympodium;* inner bark of long tough fibres. *Branches* ascending or spreading, becoming successively shorter upwards, their disposition affording valuable diagnostic characters; all young parts except the flowers, covered with partially deciduous, hirsute, simple and stellate hairs. *Leaves* membranous or subcoriaceous, varying from entire to 1- 3- 5- 7-lobed, palminerved, margins of lobes entire or sinuate; accessory lobes often rising from or above the sinuses; the central rib and usually the rib on either side of it with a *gland* on the under surface. *Stipules* falcate, entire or toothed. (The leaves of seedlings and those appearing during the rainy season are larger, more flaccid, with more distinct basal lobes, folds and sinuosities than those which are developed after a partial shedding in the cold weather. *Inflorescence* cymose, of single flowers on terminal or secondary and tertiary axes, erect or spreading, always pendulous in fruit; *peduncle* and *pedicel* short, trigonous; *involucre* or *epicalyx* of three bracteoles connate at their broadly cordate bases, margins rounded, with deep or shallow teeth, which either extend over the whole margin or are confined to the apex, which

is obtuse or acute, venation longitudinally sub-parallel. *Calyx* gamosepalous, campanulate or cupular, *limb* entire or irregularly toothed, accrescent and usually splitting in fruit, with three *glands* often secreting a nectar-like exudation at the base externally. *Corolla* polypetalous, *petals* 5, contorted dark purple, pink, yellow or white with a dark eye, straight or reflexed, adnate to the base of the *andrœcium*. *Stamens* indefinite, monadelphous, lower part of the tube usually naked, upper part (exclusive of the very apex) with one-celled *anthers* on short erect or spreading *filaments*. *Ovary* superior, syncarpous, 3-4-celled, *ovules* numerous on axile *placentas*, lower part of *style* entire, the upper exserted part of 3 to 4 more or less connate and twisted arms bearing the stigmatic surfaces. *Capsule* or *boll* usually 3- but sometimes 4-celled, almost spherical or ovoid, sub-trigonous acuminate, the point consisting of the short, persistent basal part of the style ; *dehiscence* loculicidal, *valves* strongly reflexed so that the cotton becomes pendulous. *Seed* with a hard testa and spiny hilum, naked or covered with short down called fuzz or velvet and longer unicellular twisted, white or tawny hairs which constitute the cotton of commerce.

It is customary amongst botanists to assume that the numerous forms of cotton plants have become inextricably complicated and difficult to understand and distinguish through hybridization. After seven years of almost constant observation of a large series of Indian cottons grown in parallel plots in one block on the farm at Poona, I consider that this position is untenable and select the following facts to support my contention that Indian cottons are normally self-fertilized. A large number of varieties procured from almost every part of the country has been grown in contiguous lines without hybridization occurring. Although a number of hybrids has been artificially produced, not one of these can be matched with any known variety. The stigmas are usually pollinated immediately on the opening of the flower which, moreover, remains open for a very short time. Bees and small flies are fond of visiting the glands *outside* the calyx for the sake of the nectar ; some beetles eat the petals ; but few insects enter the

flower itself before it is fertilized. The results of a long series of experiments conducted by Mr. S. V. Shevade show that emasculated flowers allowed to remain uncovered usually drop off unfertilized. In the few cases where he observed that pollen was carried to the stigmas by insects, bolls were not subsequently developed. These observations are confirmed by the experience of Mr. F. Fletcher, M.A., B.SC. (Deputy Director of Agriculture, Bombay), in Egypt and India. Many of the varieties grown in India are separated by long distances, in which cases hybridization is, of course, a physical impossibility. In districts where a mixture of varieties is habitually grown by the cultivators, no hybrid plants are to be found. The progeny of plants which are artificially cross-fertilized are usually more fertile than their parents. This proves that cross-fertilization is really of great service to the plant. The form of its flower with a dark base is an ideal insect lure, and it is difficult to understand why cross-fertilization should not prevail. The only solution to the problem appears, therefore, to lie in the fact that, in the Indian cottons, these so-called species and hybrids are merely cultivated races, evolved by time and environment from one prototype. All the evidence available to me appears to prove, almost without the probability of a doubt, that *Gossypium obtusifolium*, Roxb., the *Rozi* of Gujarāt, the most widely distributed wild and cultivated cotton in the old world, is the parent from which all our present forms have sprung. The progeny from the plants of this species grown in Poona for seven years now show characters which bring it into close relation with *G. herbaceum* and *G. indicum*. In the field it is easily distinguishable as a species by habit alone, but I find it very difficult to separate it with certainty from *G. herbaceum* or *G. indicum* in the Herbarium. The bracteoles, which are relied upon as diagnostic characters, are also misleading as they are indifferently toothed or entire in flowers from the same plant. *Gossypium Stocksii*, a wild plant of Sind, is by some considered the parent stock of Indian cottons. I cannot concur in this opinion. It resembles no Indian cotton and possesses certain characters which induce me to surmise that it is a degeneration of some American cotton.

No species cultivated in Sind at the present time resembles it in any particular.

All Indian cottons can be hybridized freely by artificial means. Hybridization of American and Indian varieties has been invariably unsuccessful both in India and in America.

A few more years of experiment and observation are necessary to prove absolutely that climate, soil and general environment are the factors which influence the tendency to variations in the cottons. If botanists and agriculturists will devote careful attention to the cottons growing in the fields throughout their provinces, a confirmation or refutation of my theory will soon be arrived at.

CHAPTER II.

A PROPOSED CLASSIFICATION OF THE INDIAN COTTONS.

THE following classification is suggested after a close study (extending over seven years) of numerous varieties grown systematically at the Poona Farm, supplemented by field observations in the cotton districts of Bombay and by information generously supplied by observers in other parts of India. This season the United States Department of Agriculture has supplied me with seeds of a long series of American forms, and I defer attempting to compile a history of the nomenclature of the cottons until I have studied these in a living state.

No method adopted in any of the numerous works extant on the Systematic Botany of the whole or parts of India has been found to meet the requirements of our present knowledge. Three years ago I worked at the subject in England and found but little enlightenment, as the material in the Herbaria is not only scanty but has never been critically examined. Parlatore's work, entitled "Le Specie dei Cotoni descritte" and that of Todaro called "Relazione Sulla Cultura dei Cotoni in Italia seguita da una Monagraphia de Genere Gossypium" are the two principal works dealing with the botany of cotton. In default of

anything better I have attempted to correlate Todaro's descriptions and figures with our plants.

As these notes are drawn up primarily for the use of Indian agriculturists, I have multiplied the number of species and varieties, knowing from my own experience that such a procedure assists to simplify what even then must still remain a subject difficult to understand. From a botanical point of view it is clearly evident that we have at the most only one true species of cotton in India, *Gossypium obtusifolium*, with its two sub-species, *G. arboreum* and *G. herbaceum*. All other forms should be treated as derivatives of these. The following species and varieties which I describe are really agricultural races, which remain fairly constant to their characters in the environment within which they have been evolved or cultivated for some considerable time. Sharing in the same descent, they are capable of being crossed with facility and their descendants are fertile.

A. Rozi and Dev Kapas Group, all the branches ascending and thickly crowded, not drooping at their extremities. *Leaves* with basal lobes and lateral folds in the sinuses. *Bracteoles* entire or only slightly toothed on the margins and apex. *Flowers* small, dark purple, pink purple or yellow. *Bolls* small or large.

1. Gossypium obtusifolium, *Roxb.*—Whole plant green. *Corolla* yellow. *Cotton* white.

,, ,, ,, *Var. nov.* Coconada. *Cotton* drab.

,, ,, ,, *Var. nov.* hirsutior. *Plant* more hairy, with a strong tendency towards *G. herbaceum*.

,, ,, ,, *Var.* Nanking. *Plants* with a tendency towards *G. neglectum*. *Bolls* and *bracteoles* large.

1. Gossypium obtusifolium, *Roxb.*—*Var. nov.* sindica. *Branching* more sparse than in type, upper branches with a strong tendency to become successively shorter. *Plants* with a tendency towards *G. indicum.*

2. Gossypium arboreum, *Linn.*—Perennial. Whole plant and corolla dark purple or red. Velvet of seeds green. Lobes of leaves narrow.

„ „ „ *var. nov.* platyloba. Lobes of leaves broad.

„ „ „ *var. nov.* vagans. *Lint* khaki.

3. Gossypium sanguineum, *Hassk.*—Annual. Plants dark purple. *Corolla* dark purple.

(*a*) broad lobed forms.

(*b*) narrow lobed forms.

„ „ „ *var. nov.* minor. *Corolla* pink purple.

(*a*) broad lobed forms.

(*b*) narrow lobed forms.

B. Herbaceum Group.—Bushes round-headed or with the apex of the stem slightly prolonged and sparsely branched. All the branches usually long and spreading *Leaves* softly hairy, light green, folds lateral only in the sinuses. *Bracteoles* round, uniformly gashed, usually spreading in fruit. *Flowers* yellow with a dark eye. (The eye in the corolla of *herbaceum* varieties shows a yellowish white circle in the centre, from which arises the staminal tube and style. This circle throws out obliquely radiating yellow narrow bands or patches unoccupied by the dark crimson of the

eye. In other types this circle is represented by a perfectly regular pentagon, having no radiating yellow lines).

4. Gossypium herbaceum, *Linn.* *Valves of boll* thoroughly reflexed so that the cotton is pendulous.

„ „ „ *var. nov.* madraspatana. With smaller bolls but otherwise as in type, of which it is probably a degenerated form.

„ „ „ *var. nov.* melanosperma. As in the last, but testa of seed naked.

„ „ „ *var. nov.* sakalia. *Bolls* large, not opening widely.

C. The Jethia Group.—Round-headed bushes, apex of stem seldom produced, branches ascending more sharply than in *G. herbaceum*. *Leaves* dark green, with lateral folds and rarely basal lobes in the sinuses. *Bracteoles* sub-triangular, gashed on the whole margin or more or less entire, not spreading in fruit.

5. Gossypium intermedium, *Todaro.* *Flowers* yellow. *Bracteoles* deeply gashed.

„ „ *var. nov.* alba. *Flowers* white. *Bracteoles* often entire. A link with *G. neglectum*.

D. The Bani Group.—Tall sparsely branched plants. *Lower branches* long slightly ascending, median and upper sparse, short, more or less drooping, becoming successively shorter, apex of simple stem much produced. *Leaves* yellowish green, entire to 3-lobed usually, lobes broadly ovate. *Bracteoles* triangular, entire or slightly toothed upwards. *Petals* reflexed, yellow or white. Cotton scanty and fine in the most typical examples.

6. Gossypium indicum, *Lamk.* *Flowers* yellow.

„ „ „ *var. nov.* Mollisoni. *Flowers* white.

E. Jari and Varhādi Group.—Tall sparsely branched plants. *Lower branches* long, slightly ascending, median and upper sparse, more or less drooping, becoming successively shorter, apex of simple stem much produced. *Leaves* dark green, strongly heliotropic. *Bracteoles* triangular, entire or slightly toothed upwards. *Petals* reflexed, yellow or white.

7. Gossypium neglectum, *Todaro var. nov.* vera. Lobes of leaves narrowly oblong, base not deeply cordate. *Flowers* yellow. *Cotton* copious and coarse.

,, ... *Sub. var. nov.* kathiavarensis. Lobes of leaves broad, ovate-oblong. *Cotton* moderately fine.

,, ,, .. *Sub. var. nov.* malvensis. Habit of type; but *Cotton* of superior quality.

,, ,, ,, *Sub. var. nov.* bengalensis. Lobes of leaves narrow, radiating. *Bolls* and *bracteoles* larger than in type. *Cotton* coarse.

,, ,, .. *Sub. var. nov.* Kokatia. As in the last, but lint drab coloured.

,, ,, .. *Sub. var. nov.* burmanica. As in *bengalensis*, but lobes of leaves broad. *Lint* white.

,, ,, .. *var. nov.* rosea. Lobes of leaves narrow. *Flowers* white. *Cotton* coarse.

7. Gossypium neglectum, *Todaro. Sub. var. nov.* cutchica. Lobes of leaves broad, ovate-oblong. *Cotton* moderately fine.

„ „ „ *Sub. var. nov.* avensis. Lobes of leaves broad. *Bracteoles* and *bolls* larger than in type.

F. Kil Group.—Low plants. Lower branches drooping, upper becoming successively shorter. *Leaves* dark green, with narrow, radiating lobes. *Bracteoles* large, triangular, acuminate, entire or only toothed at apex, longer than the flowers, reflexed in fruit. *Flowers* normally white. *Bolls* usually large.

8. Gossypium cernuum, *Todaro. Cotton* white.

„ „ „ *var. nov.* silhetensis. *Cotton* drab.

G. Dharwar American Group.—Low rounded bushes. *Leaves* rather membranous, yellowish green, simple to 5-lobed, usually 3-lobed, lobes short, triangular, with straight margins. *Bracteoles* rounded with caudate acuminate teeth. *Flowers* light yellow, without a dark eye. *Bolls* large spherical.

9. Gossypium hirsutum, *Mill. Cotton* white.

„ „ „ *var.* rufa, *Todaro. Cotton* drab.

1. Gossypium obtusifolium, *Roxb. Fl. Ind., III.*, 183 ; G. herbaceum, *Linn* var. obtusifolium (*Roxb*). *Masters in Fl. Br. India*, I, page 347 ; G. Wightianum, *Todaro, Osser sui Cotoni*, page 47. Attaining the height of 7 feet and upwards. *Stems* robust, internodes short, all the branches acutely ascending and crowded. *Branches* dark red, with close, very short, stellate hairs mixed with longer, simple pilose hairs as are also the petioles and leaves. *Leaves* small, standing on the same plane as the petiole or at right angles to it, yellowish green with a distinct red blotch at base, 5-lobed, lobes ovate, rather obtuse mucronate, sinus broad or narrow, with a small extra lobe or fold, margins of some of the larger leaves sinuate. *Stipules* rather short, lanceolate, falcate.

Peduncles 1 or 2, on secondary and tertiary divisions, reflexed, trigonous. *Bracteoles* $\frac{3}{4}$ to 1 inch by $\frac{5}{8}$ to $\frac{7}{8}$ inch, ovately triangular acute, teeth rather shallow and acute, usually confined to the upper third but occasionally present on the whole of the margins. *Calyx* loose, campanulate, truncate or minutely 3-toothed, with three distinct glands on the base externally. *Corolla* up to $1\frac{3}{4}$ inch long, yellow with a dark eye, fading red. *Stigmas* united, slightly twisted. *Bolls* $1\frac{1}{8}$ to $1\frac{1}{4}$ inch by $\frac{3}{4}$ to $\frac{7}{8}$ inch, long pointed when 3-celled, short pointed when 4-celled. *Cotton* scanty, moderately fine and curly, *seeds* with a greenish gray velvet.

Indian Forms.—*Rōzi* or *Jaria*, a perennial growing for 6 or 7 years, cultivated on the light soils of Gujarāt. Professor Middleton says that it readily runs wild and in hedges assumes a climbing habit and then the cotton turns yellow and very short in the staple, the velvet at the same time becoming long; that it strongly resembles *G. arboreum*, the chief difference being a yellow flower and the absence of the marked reddish tinge possessed by that species.

Nadam. Madras. Mr. Benson, M. R. A. C. (late Deputy Director of Agriculture, Madras), says that Nadam and Bourbon are the crops of the lighter and more gravelly soils.

G. obtusifolium, *Roxb. var. nov.* Coconada. This differs from the type in having drab instead of white cotton. Mr. Benson says that the centre of trade in this cotton is at Gūntur.

G. obtusifolium, *Roxb. var. nov.* hirsutior. Plants more hairy, leaves larger and altogether with a strong tendency towards *G. herbaceum.*

Two forms have been received from Baluchistan under the names of *Keehi Kapās* and *Karpās.* I place these plants here mainly on account of their manner of growth. Many of their characters bring them very closely indeed to *G. herbaceum.* The majority of the forms, ranging from Baluchistan westward to the Mediterranean, arranged under *G. herbaceum*, may really belong here, but I have seen only herbarium examples of these.

G. obtusifolium, *Roxb. var. nov.* Nanking. With most of the characters of the type, but leaves of a darker green resembling those of *G. neglectum. Bolls* and *bracteoles* comparatively large.

The types are *Wa-gale* and *Wa-gyi* of Burma with good cotton and two cottons from seed imported from China. This may be *G. Nanking*, Meyen. The Chinese plants have not grown well, but they seem closely allied to the two Burmese forms included with them.

G. obtusifolium, *Roxb. var. nov.* sindica. Branches more sparse and spreading than in type, upper with a strong tendency to become successively shorter. *Leaves* larger, of a bright yellowish green colour resembling those of *G. indicum.* This variety may be a connecting link between *G. obtusifolium* and *G. indicum.* The type is recorded from Sind only.

The extra-Indian distribution of *G. obtusifolium*, Roxb. includes the Philippines (*Vidal*), where it is wild, Timor, Letti and Lakor in the Malayan Archipelago, Nyassa Land, Central Africa, Transvaal, Madagascar, Hadramant (*T. Bent*), Zambesi, Somali Land and Rhodesia. Dr. Masters says in Fl. Brit. India, I, page 347, that this was the form found in Ava by Griffith, Journals, page 147. Many of the extra-Indian specimens quoted under *G. herbaceum* may more properly come here, but it is impossible to decide the matter from herbarium materials alone.

2. Gossypium arboreum, *Linn. Sp. Pl., p.* 693 (1753), *Todaro l.c. G. album*, Ham, *teste Herb. Wight*, 176; *Roxb. Fl. Ind., III*, 183. Perennial, reaching 7 feet in height. *Stems* robust, internodes short, all the branches acutely ascending. *Branches* dark red with close, very short stellate hairs mixed with longer, simple, pilose hairs, as are also the petioles and leaves. *Leaves* 5-lobed, lobes narrowly oblong or ovate-oblong sub-obtuse mucronate, sinus broad, often with small accessory basal or lateral lobes. *Inflorescence* in short secondary and tertiary divisions of lateral branchlets, drooping. *Bracteoles* ovately triangular acute, 1 inch by $\frac{7}{8}$ inch average length and breadth, quite entire or 1—3

toothed at apex or with teeth extending throughout two-thirds of the margins. *Corolla* about one-third longer than the bracteoles, dark red, fading almost to a black colour. *Calyx* loose, campanulate, limb truncate or with a few minute teeth, tube with three distinct glands at the base externally. *Bolls* brown, opening fully when ripe so that the cotton hangs down, as long as or a little longer than the bracteoles, ovate pointed, obtusely trigonous, $1\frac{1}{8}$ inch long by $\frac{7}{8}$ inch broad, cells usually 3. *Cotton* scanty, moderately fine and curly ; *seeds* 3 to 8 in each cell, *velvet* greenish grey.

The type has the lobes of the leaves narrow. Many examples have been received from Gujarāt, United Provinces, Madras, Central Provinces, Burma and Central India. Wherever found, it seems to be cultivated only on a very small scale. According to Hove, this red-flowered perennial cotton was cultivated largely in Gujarat.

G. arboreum, *Linn. var. nov.* platyloba. This only differs from the type in having the lobes of the leaves broad. Examples were obtained from Madras Presidency only. Mysore, *Heyne*, in Herb. Kew. Serampore, Bengal, *Griffith*, Herb. Kew.

G. arboreum, *Linn. var. nov.* vagans. This differs from the type in having drab-coloured cotton. The only examples are from Central India and Madras. A form of this variety may be partly *G. Nanking*, Meyen.

The extra-Indian distribution of *G. arboreum*, Linn., includes the type in Java (Horsfield) and Siam (Zimmermann). The *variety* platyloba is found in Japan (Oldham, Maximowicz), Pekin (Bushell, Index Floræ Sinensis under *G. herbaceum*, L.), Yunnan (Delavay), China (cultivated, A. *Henry*, No. 11,024), Formosa (cultivated, A. *Henry*, 1899), Shanghai (cultivated, Carles, 388), China (Fortune), Celebes (Riedel), Abeokuta (Irving), and Central Africa.

3. Gossypium sanguineum, *Hassk. Cat. Hort. Bog.* 200, (1844), *Todaro, l. c.*, G. rubicundum, *Roxb. Ic. Ined. et in Herb.* This differs from *G. arboreum* in being of more spreading growth, not so decidedly red in colour and in the foliage

being of a more glaucous hue. The typical form has dark red flowers.

(*a*) *Leaves* with broad lobes. Types—*Bagar siah*, *Bagar safed* and *Lyallpur Farm selected*, all from the Punjab.

(*b*) *Leaves* with narrow lobes. Types—Forms of *Bagar siah* and *Bagar safed* of the Punjab.

G. sanguineum, *Hassk. var. nov.* minor. As in type, but plants with pink flowers.

(*a*) *Leaves* with broad lobes. Forms of *Bagar siah*, *Bagar safed and Deshi Multan* of the Punjab.

(*b*) *Leaves* with narrow lobes. Forms of *Bagar siah* and *Bagar safed* of the Punjab.

The extra-Indian distribution of *G. sanguineum* is uncertain and probably coincides with that of *G. arboreum*.

4. GOSSYPIUM HERBACEUM, *Linn. Sp. Pl. I., p. 693* (1753) *Masters in Fl. Brit. Ind., I., p. 346* (excluding all the four varieties), *Todaro l. c.* Varying in height from 2 to 7 feet, basal branches long and spreading, median and upper also long and spreading, drooping in fruit; older parts greyish brown, slightly hairy, young parts green covered with black dots and soft, white spreading hairs; the sides of the branches facing southwards gradually turning to a dark red colour. *Stipules* ovate to linear lanceolate, falcate, about $\frac{1}{2}$ inch long, the broader ones sometimes lobed towards apex. *Leaves* rather membranous, yellowish green, shallowly cordate rotundate, palmately 3—5 more lobed, lobes deep ovate obtuse or acute, margins quite entire or sinuate, sinus folded; basal lobes, when present, are above the sinus and do not rise from it. *Inflorescence* on short secondary or tertiary axes. *Bracteoles* spreading in fruit, rounded, with about 8—10 lanceolate acuminate teeth, reaching one-fourth of the way down. *Calyx* cup shaped, entire, accrescent and irregularly splitting, with three external basal glands. *Corolla* yellow with a black eye, fading to yellow suffused with red, $\frac{1}{2}$ to $\frac{3}{4}$ inch longer than the bracteoles, *anthers* dark yellow with rather short filaments, *stigmas* short, channels straight or slightly twisted. *Capsule* 3

or 4-celled, almost spherical or ovate, pointed, shorter than the spreading bracteoles. *Seeds* 5 to 8 in each cell.

Typical examples are *Lālio* of Kathiawar. *Kumpta* and *Jowāri Hatti* of the Southern Mahratta Country, *Broach*, *Gogāhri*, *Lālio* (Chhārodi) and *Kānvi*, all of Gujarat.

G. herbaceum, *Linn. var. nov* madraspatana. With smaller bolls but otherwise as in type, of which it is probably a degeneration. Typical examples include the *White-seeded Jowāri Hatti*, *Mungari* or *Billai*, *Uppam*, *Northerns* (Cuddapah), *Proddatur*, all of the Madras Presidency. *Manvi* (Pratabgarh) is the solitary representative in the United Provinces. Mr. Benson says that 'Westerns' include *Jowāri Hatti* (white and black seeded), *Mungari* and *Bilé Hatti* and that these are found on the loams and clays. The trade term 'Northerns' includes the Northerns of this list and *Yerraputti* (*G. indicum*), the distribution being mainly according to soil as above. *Salems* include three different varieties, *viz.*, *Uppam*, *Nadam* or *Ladam*, and *Bourbon*. The *Uppam* resembles in every way, except that the lint is harsher, the *Uppam* of the districts further south and is the crop of clays and loams. The trade term 'Tinnies' includes the *Uppams* and "*Mundai kai* and *Karunganni*" or "*Manji kai*" varieties. These two sorts are habitually sown mixed, but the proportion of *Uppam* is larger in the north and of *Karunganni* in the south. It seems probable that the latter is the true Tinny Cotton, for *Uppam* is known in some places as *Udamalpet* cotton, Udamalpet being a town in the 'Salems' area. *Mungari* is a special sort which appears to differ from the ordinary *Jowāri* (not *Jowāri Hatti*) in respect of the time of sowing. *Karunganni* belongs to *G. obtusifolium*, Roxb.

G. herbaceum, *Linn. var. nov.* melanosperma. As in the last, but testa of seed naked. There is only one typical example from the Madras Presidency, said by Mr. Benson to be included in 'Westerns.'

G. herbaceum, *Linn. var. nov.* sakalia. *Bolls* spherical, with broad valves splitting so slightly when ripe that the cotton does not emerge, mostly 3-celled, averaging one inch in length and

breadth. The typical examples are two only ; *Wāgad* and *Sakālio* of Gujarat.

I am altogether in doubt as to the extra-Indian distribution of G. herbaceum, *Linn.*, having never seen living examples of the cottons ranging from the western frontiers of India to Eastern Europe and included under this name. Specimens from the following countries seem to belong to this species, but they may just as well be considered forms of *G. obtusifolium*, Roxb. : Turkey, Greece, Armenia, Persia, Cephalonia, Crete, Khorasan (*Aitchison*), Afghanistan, Gilgit (*Giles* and also *Winterbottom*).

5. Gossypium intermedium, *Todaro, Osser sui Cotoni, p. 41 (1863)* ; G. intermedium, *Tod. var.* Royleanum, *Tod. l.c.* = ? broad-lobed type ; G. neglectum, *Tod. var.* Roxburghianum, *Tod. l.c.* = ? G. herbaceum *var.* Dacca Cotton, *Roxb. Fl. Ind. III, 184*, teste *Tod. l.c.* = ? *Jethia* of Bengal. Attaining 5 to 6 and more feet in height, *branches* ascending more sharply than in *G. herbaceum*, reddish. *Leaves* dark green, sub-coriaceous, glabrescent, palmately 5—7-lobed, lobes ovate acute, sinus broad with a fold or rarely with an extra-basal lobe. *Bracteoles* not spreading, subtriangular, ovate, gashed more or less on the whole margin. *Bolls* small $\frac{7}{8}$ by $\frac{5}{8}$ inch, round and pointed. *Cotton* scanty, short, moderately fine ; *seeds* 3 to 8 in each cell, velvet greenish white. The following forms are transitional between the Burmese and Chinese types of *G. neglectum* and *G. herbaceum*.

(*a*) Lobes of leaves broad. *Dēshila* or *Dēshi* and *Jēthi* of Bengal, *Bāgil* of Gorakhpur, U. P.

(*b*) Lobes of leaves narrow, *Sūltānpur* ; *Rādhiya kapās* ; *Mānva* of the United Provinces.

G. intermedium, *Tod. var. nov.* alba. *Flowers* white. *Bracteoles* often entire. A form nearer *G. neglectum* than *G. herbaceum*. Type from United Provinces only. Mr. Moreland (Director of Agriculture, United Provinces) says that these cottons are cultivated on a small scale only on the eastern side of the Upper Provinces.

The extra-Indian distribution of *G. intermedium*, Tod., is unknown. The plant is probably endemic. There are no specimens at Kew.

6. Gossypium indicum, *Lamk. Dict. Encycl. 2, p. 134* (1786): G. Wightianum, *Tod. Osser sui Cotoni, p. 41* (in part). *Stems* up to 8 feet in height, simple, tapering gradually from base to apex; basal branches long, ascending, medial moderately long, uppermost small. *Leaves* varying from entire to usually 3- or occasionally 5-lobed, base cordate, lobes broadly ovate, sinuses broad. *Bracteoles* ovate-pointed, entire or few toothed at apex. *Bolls* ovate acuminate, 3—4-celled; *cotton* scanty, staple silky, long; *seeds* in each cell 4—10, covered with grey brown velvet. Typical plants have yellow flowers. Bengal and Madras have each one form; the United Provinces have two; the remainder come from Central India, the Punjab and the Central Provinces.

Of *Yerraputti* Mr. Benson says that it seems, like *Karunganni*, to partake more of the *G. indicum* than of the *G. neglectum* type, but possibly it includes more than one variety. Plants so named are found widely as scattered plants in greater or less proportion over the areas where both Northerns and Westerns are produced. Properly speaking, this variety is not one to be grown on "Cotton soils."

As regards the Central Provinces, Mr. Standen (Director of Agriculture) says that *Bani* is a more delicate and later ripening variety with longer and silky staple. It used to be grown largely in the Wardha district as well as in the neighbouring parts of Berar, but is being thrust out by the *Jari* (G. neglectum), because the latter even in the most favourable years pays better than *Bani* in all but the most suitable localities. The Assistant Director of Agriculture believes that *Nimari* is *Bani*, of which the character has been somewhat altered by transfer to a drier climate. The *Chandā Jari* is a cold weather variety yielding a smaller outturn than *Jari* or *Bani*, but producing cotton of better quality than either. From Mr. Shevade's report on the cotton of Barsi in the Sholapur District, it would appear that *Bani* once formed the bulk of the so-called Barsi cotton.

Gossypium indicum, *Lamk. var. nov.* Mollisoni differs from the type only in having white flowers. The examples are all

from Central India and the Punjab, with the exception of one from the Central Provinces and two from the United Provinces.

The species seem to be endemic to India.

7. GOSSYPIUM NEGLECTUM, *Todaro, Osser sui cotoni, p. 35 (1863).* G. herbaceum, *Linn var.* hirsutum, *Masters* in Herb. Kew. G. arboreum, *Linn.* (in part) *Fl. Br. Ind., I, 347.* Plants varying in height from 3 to 7 and more feet. *Stems* simple, wandlike, tapering gradually from base to apex, bark brown, tessellated, quite glabrous below, with simple, white short deciduous hairs above, herbaceous parts brownish red, specially so on the southern side. Lower branches sparse, long, spreading, medial short, uppermost very short; whole plant usually nodding if well covered with fruit. *Leaves* palmate or palmatipartite, lobes 3 to 5 or more, oblong lanceolate, ovate acute or sub-obtuse, sinuses broad or rising up into small extra lobes, base shallowly cordate; *glands* either altogether absent or present on the central rib or faintly present on the three central ribs; *stipules* lanceolate falcate acuminate or broad ovate few toothed at the apex. *Flowers* one from each node of the lateral branches, *peduncles* erect but drooping in fruit. *Bracteoles* deeply cordate, ovate acute, quite entire towards apex or sometimes toothed there. *Calyx* cup-shaped, entire or very shortly lobed. *Corolla* a little longer than the bracteoles, upper part of petals reflexed; *filaments* comparatively long; *stigmas* 3-grooved, scarcely rising above the upper anthers, channels with or without black dots. *Bolls* ovate, obtusely pointed, invested at base by the ruptured enlarged calyx, 3—4-celled, very distinctly black dotted, valves separating and recurved when ripe. *Cotton* harsh, clinging more or less firmly to the seed, which is covered by grey velvet.

G. neglectum, *Tod. l.c. var. nov.* vera. Lobes of leaves narrowly oblong, base not deeply cordate. *Flowers* yellow. *Cotton* copious and coarse. This variety is represented by forms from the Punjab, United Provinces and Central India. The latter area seems to have been the place of origin of both this species and *G. indicum.*

G. neglectum, *Tod. var. nov.* vera., *sub. var. nov.* malvensis. Similar to the last but lobes of leaves usually broader and the

cotton of superior quality. This form is a connecting link with *G. indicum.* Examples are from Sind, Punjab, Central India and the United Provinces.

G. neglectum, *Tod. var. nov.* vera, *sub. var. nov.* kathiavarensis. Lobes of leaves broad ovate oblong. *Cotton* moderately fine. It is represented by two varieties from Kathiawar, *Hirvāni* and *Mathio* and doubtfully by a variety called *Barkley*, Ralli Brothers, in the Central Provinces.

G. neglectum, *Tod. var. nov.* vera, *sub. var. nov.* bengalensis. Lobes of leaves narrow, radiating. *Bolls* and *bracteoles* larger than in type. *Cotton* coarse. It is represented by several examples in Bengal, three in Assam and one in the United Provinces. It is closely allied to *G. cernuum.*

G. neglectum, *Tod. var. nov.* vera, *sub. var. nov.* burmanica. As in bengalensis, but lobes of leaves broad, *cotton* white. It is represented by a series of similar forms from Burma and by three varieties from Assam. The Director of Agriculture states that *Lassing Anguangba* or *Tissing Anguangba* is grown in Manipur.

G. neglectum, *Tod. var. nov.* vera, *sub. var. nov.* Kokatia. Characters as in the last, but *cotton* drab coloured. One example from Bengal, two from Assam and a short series from Burma. This may be one of the forms included by authors under *G. Nanking,* Meyen.

G. neglectum, *Tod. var. nov.* rosea. G. roseum, *Tod. Osser sui Cotoni*, p. 22. This is separated from G. neglectum, *var.* vera, only by the white flowers. There are examples from the Central Provinces, Punjab, United Provinces, Bengal and Sind.

G. neglectum, *Tod. var. nov.* rosea, *sub. var. nov.* cutchica. Lobes of leaves broad, ovate oblong; *cotton* moderately fine. Represented by three white-flowered cottons of Kathiawar, *Hirvāni, Mathio* and *Mōtō mathio.*

G. neglectum, *Tod. var. nov.* rosea, *sub. var. nov.* avensis. Lobes of leaves broad. *Bracteoles* and *bolls* larger than in type. Represented by two Burmese cottons and one doubtful plant from the United Provinces.

The extra-Indian distribution of *G. neglectum, Tod.*, is unknown.

8. Gossypium cernuum, *Tod. Osser sui Cotoni*, p. 31. General characters as in *G. neglectum*. *Leaves* usually with very narrow radiating lobes. *Bracteoles* ovate acute, quite entire towards apex or with 3 to 6 acuminate teeth; dimensions in flower 1 to 2 inches long, $\frac{3}{4}$ to $1\frac{1}{4}$ inch broad. *Corolla* about $\frac{3}{4}$ inch longer than the bracteoles, white or pale yellow, with a dark eye, dying pink. *Bracteoles* in fruit up to $2\frac{1}{2}$ inches long, slightly shorter or longer than the bolls which are ovate pointed, 3—4 celled, very distinctly black dotted. It is represented by a series of forms in Assam, by an introduced variety in Sind and by another variety, perhaps also introduced, in the United Provinces. The Director of Agriculture, Assam, states that the *kil* is grown in the Garo Hills and probably also on the northern slopes of the Khasia Hills. Its pods are very large, being sometimes as much as eight inches in length. The quality of the lint is harsh and only fit for mixing with wool. *Bor Kapah* and *Soru Kapah* are grown in the Mikir Hills and in the adjacent plains country in Nowgong and Golaghat by the hill tribes (mostly Mikirs). They are also grown to a very small extent in some plain's mauzas of Kamrup.

G. cernuum, *Tod. var. nov.* silhetensis. Differs from the type only in having drab-coloured cotton. It is represented by four examples from Assam, one introduced into Sind and one Chinese. The last may be one of the forms known as *G. Nankíng*, Meyen.

The extra-Indian distribution of *G. cernuum, Tod.*, is doubtful, but it is probably endemic in North-Eastern India and China.

9. Gossypium hirsutum, *Mill. n.* 4 (1759) = G. jamaicense, *Macf. Fl. of Jamaica*, p. 72 = ? G. punctatum, *Thon. and Sch.* Guin Pl. p. 2, p. 84. Upland Georgian cotton, *Royle, Cotton Cultivation, tab.* 3, *fig.* 4. Upland Georgian cotton; Short Staple cotton; Bourbon cotton; Louisiana cotton (*Parlatore*). From 2 to 4 feet high. Lower branches erect, upper spreading

so that a well-grown plant forms a round-headed bush ; older parts of the stems and branches smooth, grey ; younger parts green, gradually turning brown, covered with moderately stiff spreading white hairs and minute black dots ; *stipules* lanceolate, falcate, about ½ inch long. *Leaves* sub-coriaceous, dark green, drying red, varying much in shape, ovate or ovate cordate entire, cordate with I to 3 shallow lobes or palmately cordate with 3 shallow or very deep triangular or ovately triangular acute lobes which point forwards, base of blade with a red blotch. *Bracteoles* rounded, upper half of the margins with about ten falcately lanceolate acuminate teeth, the central ones exceeding the corolla in length, in bud and fruit clasping over like the fingers of two hands. *Calyx* campanulate, accrescent but not usually splitting in fruit, with 5 distinct triangular lobes. *Corolla* pale yellow without an eye, fading red. *Anthers* with rather long filaments so that they droop. *Stigmas* long, consolidated, twisted. *Bolls* usually 3- , sometimes 4-celled, spherical ovate obtuse shortly mucronate with the persistent base of the style a little longer than the bracteoles. *Cotton* silky, long in the staple. *Seeds* densely covered with grey velvet, 6—9 in each cell.

This species is only included amongst the Indian cottons, as it has become quite naturalized in some parts of India, especially in the Karnatak. There are examples from Dharwar, Nagpur, Central Provinces, Assam, Bengal, United Provinces and Punjab.

G. hirsutum, *Mill. var.* rufa, *Todaro.* Only differs from the type in the cotton being drab coloured. Synonymy according to Parlatore is, G. siamense lana rufa, *Ten. l. c.* G. religiosum, *Moris. Fl. sard. I,* p. 309. Coton de Siam, Cotone Isabelle of the French, Cotone siamese, Cotone maltese, Cotone Rosso, Cotone color di legno. We have examples from the Punjab, United Provinces and Central India.

As regards the extra-Indian distribution of G. hirsutum, *Mill.*, Parlatore gives Mexico and Galapagos as the habitat. It is cultivated in Central and North America, Canary Islands, Cape Verde, Western Coast of Tropical Africa, Algeria, Egypt, Abyssinia, Isle of France, Bourbon, Southern Italy, Sicily,

Sardinia, Malta, Crete, Indo-China, Amboyna, Queensland, New South Wales and New Holland. I have personally examined specimens from the following localities: Angola, St. Jago, San Domingo, Lagos, (wild cotton of Radajry District), Zambesi, Egypt, Alabama, Florida (under G. uliginosum, *Linn.*), Costa Rica, Mexico, Florida (under G. racemosum, *Poir.*).

DESCRIPTIONS OF THE PLATES.

PLATE I.—G obtusifolium, *Roxb.*; A. *Nadam of Madras*, B. *var.* Coconada, open boll. C. seed without cotton.

PLATE II.—G. obtusifolium, *var.* hirsutior; A. part of plant; B. open flower; C. half ripe boll; D. ripe boll; E. seed with cotton; F. seed without cotton; G. bracteole.

PLATE III.—G. obtusifolium, *var.* Nanking; A. part of plant; B. open flower; C. half ripe boll; D. ripe boll; E. seed with cotton; F. seed without cotton; G. bracteole.

PLATE IV.—G. obtusifolium, *var.* sindica; A. part of plant; B. open flower; C. two types of bolls; D. bracteole.

PLATE V.—G. arboreum, *Linn*; A. part of typical plant; B. leaf of *var.* platyloba; C. ripe boll and cotton of *var.* vagans; D. ripe boll and cotton of type; E. seed with cotton of type; F. seed without cotton of type; G. bracteole.

PLATE VI.—G. sanguineum, *Hassk*; A. part of plant of *var.* minor; B. petal of same; C. a broad-lobed leaf; D. flower of type; E. bracteole of type; F. seed with cotton; G. seed without cotton; H. unripe boll of *var.* minor; I. ripe boll of *var.* minor; J. ripe boll of type.

PLATE VII.—G. herbaceum, *Linn.* A. part of plant of type; B. boll of *var.* madraspatana; C. seed with and without cotton of *var.* melanosperma; D. ripe boll of *var.* sakalia; E. half ripe boll of type; F. open flower of type; G. ripe boll of type; H. seed with and without cotton of type.

PLATE VIII.—G. intermedium, *Tod.*; A. part of plant of type; B. part of plant of *var.* alba; C. D. bracteoles of *var.* alba; E. half ripe boll of *var.* alba; F. ripe boll of same; G. seed with and without cotton of type.

PLATE IX.—G. indicum, *Lamk.*, and G. neglectum, *Tod. var.*; A. part of plant of type; B. flower of *var.* Mollisoni; C. half ripe boll of type; D. ripe boll of type (marked G. in left hand lower corner); E. seed with and without cotton of type; F. ripe boll of *Lassing Anguangba*; G. seed with and without cotton (transferred to G. neglectum, *var.* vera. *sub-var.* Kokatia).

PLATE X.—G. neglectum, *Tod. vars.* vera. and rosea; A. part of plant of G. neglectum, *var.* rosea; B. flower of *var.* vera.; C. leaf of *var.* vera. *sub. var.* malvensis; D. bracteole of *var.* rosea; E. ripe boll of the same; F. seed with and without cotton of the same.

PLATE XI.—G. neglectum, *Tod. sub. vars.* cutchica and kathiavarensis; A. part of plant of *var.* rosea, *sub. var.* cutchica; B. flower of *var.* vera. *sub. var.* kathiavarensis; C. bracteole of *sub. var.* cutchica; D. ripe boll of same; E. seed with and without cotton of same.

PLATE XII.—G. neglectum, *Tod. sub. vars.* burmanica and Kokatia; A. part of plant of *var.* vera, *sub. var.* burmanica; B. flower of same; C. bracteole of same; D. half ripe boll of same; E. ripe boll of same; F. seed with and without cotton of same; G. ripe boll of *sub. var.* Kokatia.

PLATE XIII.—G. cernuum, *Tod.*, G. neglectum, *var.* vera, *sub. var.* bengalensis; A. part of plant of type; B. bracteole of type; C. half ripe boll of type; D. ripe boll of same; E. ripe boll of *var.* silhetensis; F. flower of G. neglectum, *var.* vera., *sub. var.* bengalensis; G. half ripe boll of same.

PLATE XIV.—G. hirsutum, *Mill.* A. part of plant of type; B. flower of same; C. bracteole of same; D. half ripe boll of same; E. ripe boll of same; F. seed with and without cotton; G. ripe boll of *var.* rufa.

R. K. Bhide, del.

G. OBTUSIFOLIUM Roxb.

Huth, Lith^r London.

M. A. Rhodes del.

G. OBTUSIFOLIUM var HIRSUTIOR.

Hulth, Lith^r London.

C.

B

A.

E.

F.

D.

C.

R. K. Bhide, del.

Huth, Lithf. London

G. OBTUSIFOLIUM Roxb. Var. NANKING.

F. K. Fuidge del

G. OBTUSIFOLIUM Roxb var SINDICA.

Huth, Lith^r London

R.K.Bhide, del.

G. ARBOREUM Linn.

Huth, Lith^r London.

R K Bhide, del

G. SANGUINEUM. Hassk.

Huth, Lith^r London

G. HERBACEUM Linn.

Roth Lith. London.

R. K. Bhide, del.

G. INTERMEDIUM Tod.

Huth, Lith. London

R. K. Bhide. del.

Huth, Lith^r London

G. INDICUM. Lamk. and G. NEGLECTUM. Tod. var.

R K Bhide, del. G. NEGLECTUM. Tod. vars. VERA and ROSEA. Huth, Lith^r London

R.K.Bhide. del. Huth, Lith^r London

G. NEGLECTUM. Tod.
sub. vars CUTCHICA and KATHIAWARENSIS.

R.K.Bhide, del.

G. NEGLECTUM. Tod.
sub vars BURMANICA and KOKATIA

Huth Lith^r London

R.K.Bhide del.

G. CERNUUM. Tod.
G. NEGLECTUM. var VERA sub.var. BENGALENSIS.

Huth Lithº London.

G.

E.

C.

A.

F.

B.

D.